

Metaverse and the Future of glTF

Nathaniel Hunter (Infinite World), Neil Trevett (NVIDIA),
Leonard Daly (Daly Realism), Brent Scannell (Autodesk),
Dwight Rodgers (Adobe), Pawel Nikiel (CG Trader)

VISIT...

LANZAROTE
Caliente.COM

Today's Presenters



Neil Trevett
(NVIDIA)



Nathaniel Hunter
(Infinite World)



Brent Scannell
(Autodesk)



Leonard Daly
(Daly Realism)

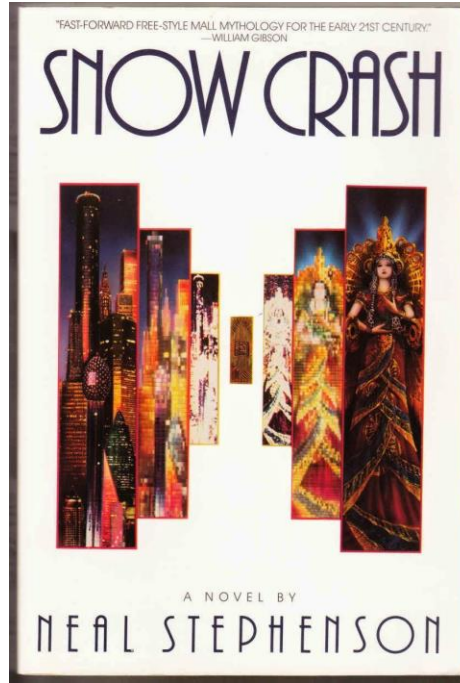


Dwight Rodgers
(Adobe)



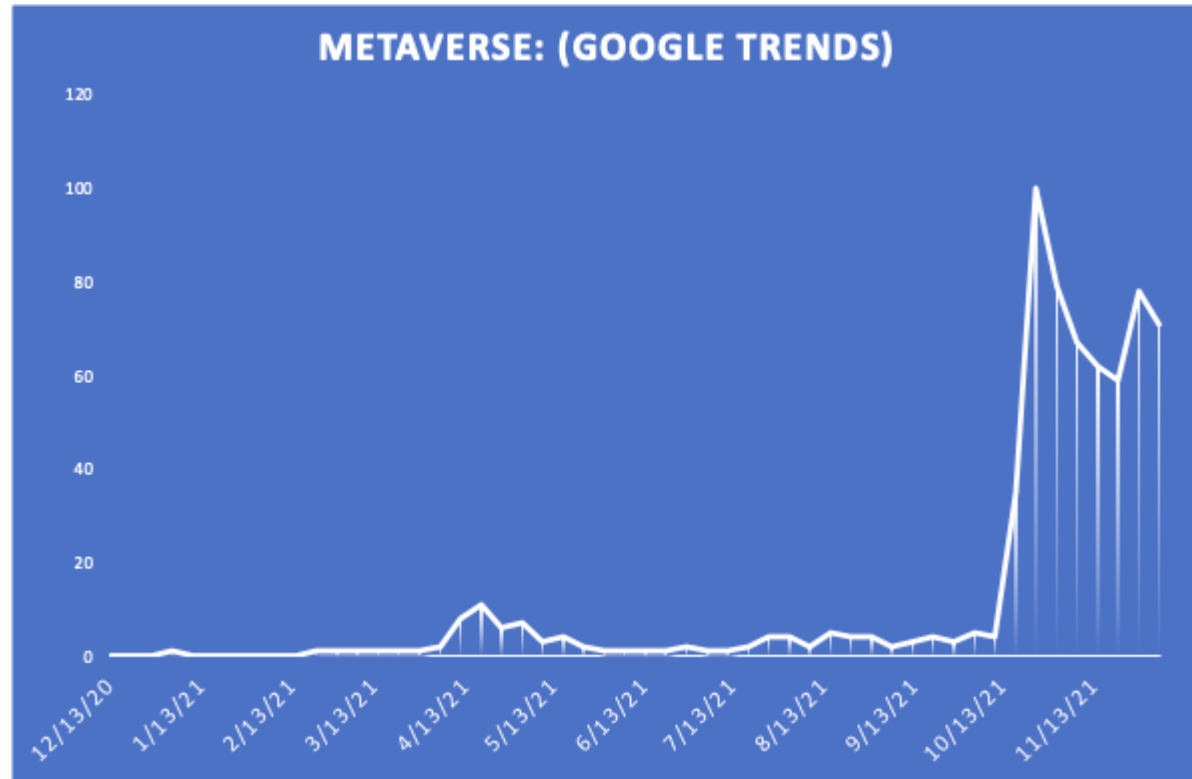
Pawel Nikiel
(CG Trader)

Metaverse Origin



June 1992

The Metaverse is still “new”



Metaverse Explanation

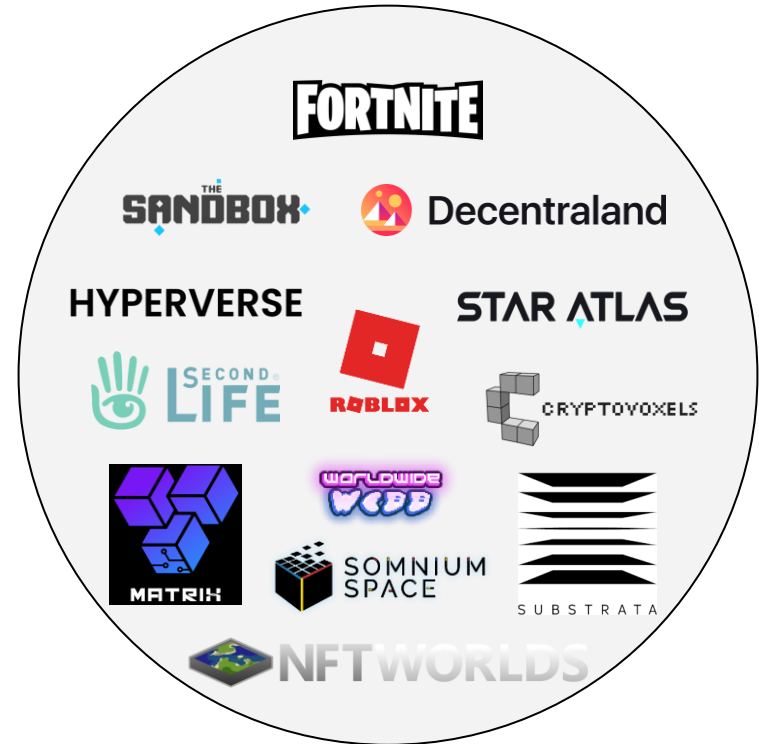
**It's not a destination...
or a platform...
or an app...**

It's a metaphor

Metaverse / Internet Comparison



The Internet
~1.16B sites



The Metaverse
hundreds of worlds/spaces

Metaverse Rules

Tony Parisi's Metaverse Rules

Rule #1. There is only one Metaverse.

Rule #2: The Metaverse is for everyone.

Rule #3: Nobody controls the Metaverse.

Rule #4: The Metaverse is open.

Rule #5: The Metaverse is hardware-independent.

Rule #6: The Metaverse is a Network.

Rule #7: The Metaverse is the Internet.

<https://medium.com/meta-verses/the-seven-rules-of-the-metaverse-7d4e06fa864c>

Web3

- **Web1 - Worldwide Web**
- **Web2 - User generated web**
- **Web3 - Decentralized Internet**

The difference between...

WEB3

The decentralized internet built on distributed technologies

- Blockchain
- DAO's
- ~~- centralized on servers owned by individuals or corporations.~~

METaverse

A shorthand for virtual worlds or spaces

- users can interact with each other
- engage with apps and services in a far more immersive way.

What the Metaverse ISN'T today

- It isn't any single platform or experience
- It's not ALL on the Blockchain
- It isn't just games
- Experiences are NOT all interoperable
- There are no guidelines or standards for content
- It isn't finished, figured out or finalized

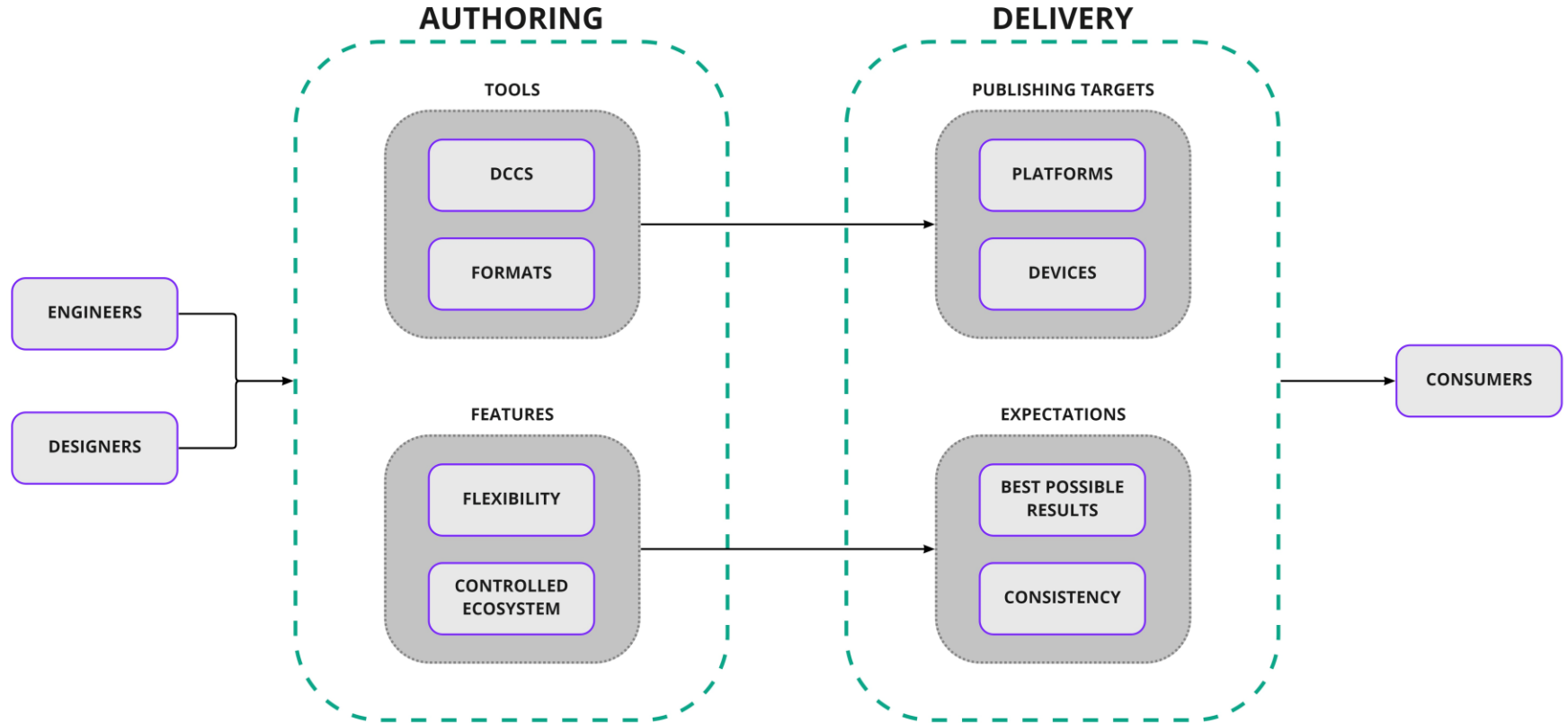
What we'll focus on today

- The high level glTF roadmap
- A deeper dive into glTF topics
- Geospatial and WC3 tie-ins
- How glTF can help with interoperability & consistency
- The Metaverse Standards Forum hosted by Khronos

A BRIEF OVERVIEW OF ASSET JOURNEY

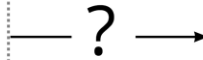
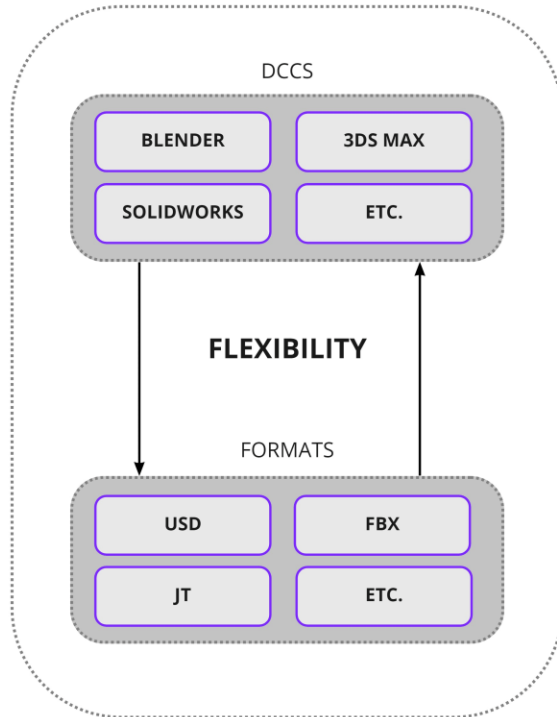
Paweł Nikiel (CGTrader)

ASSET JOURNEY

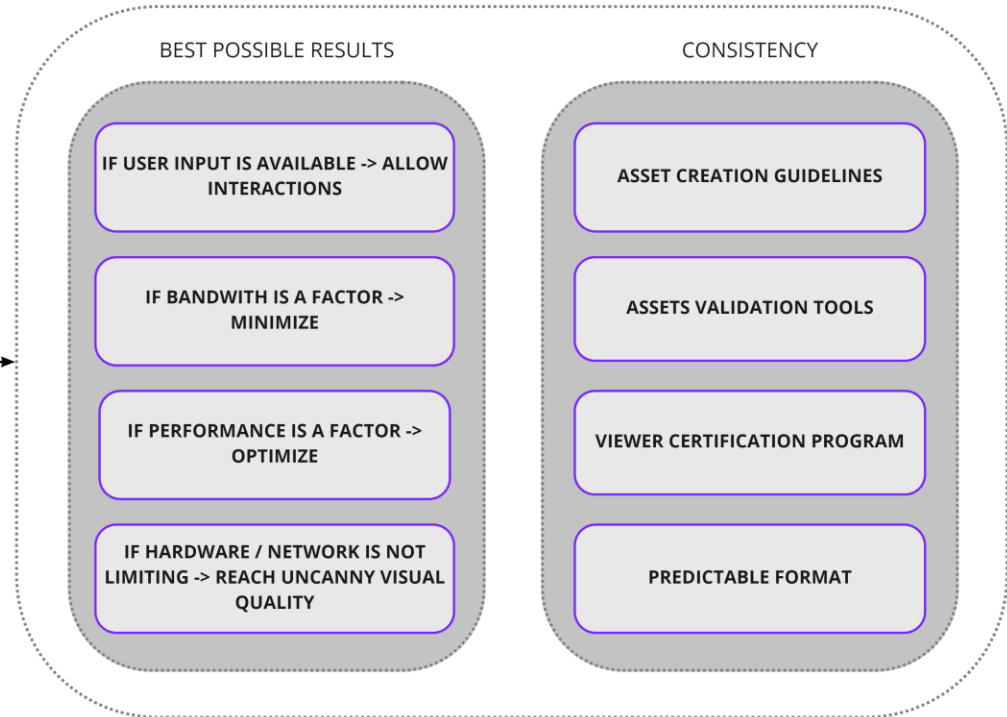


TRANSITION

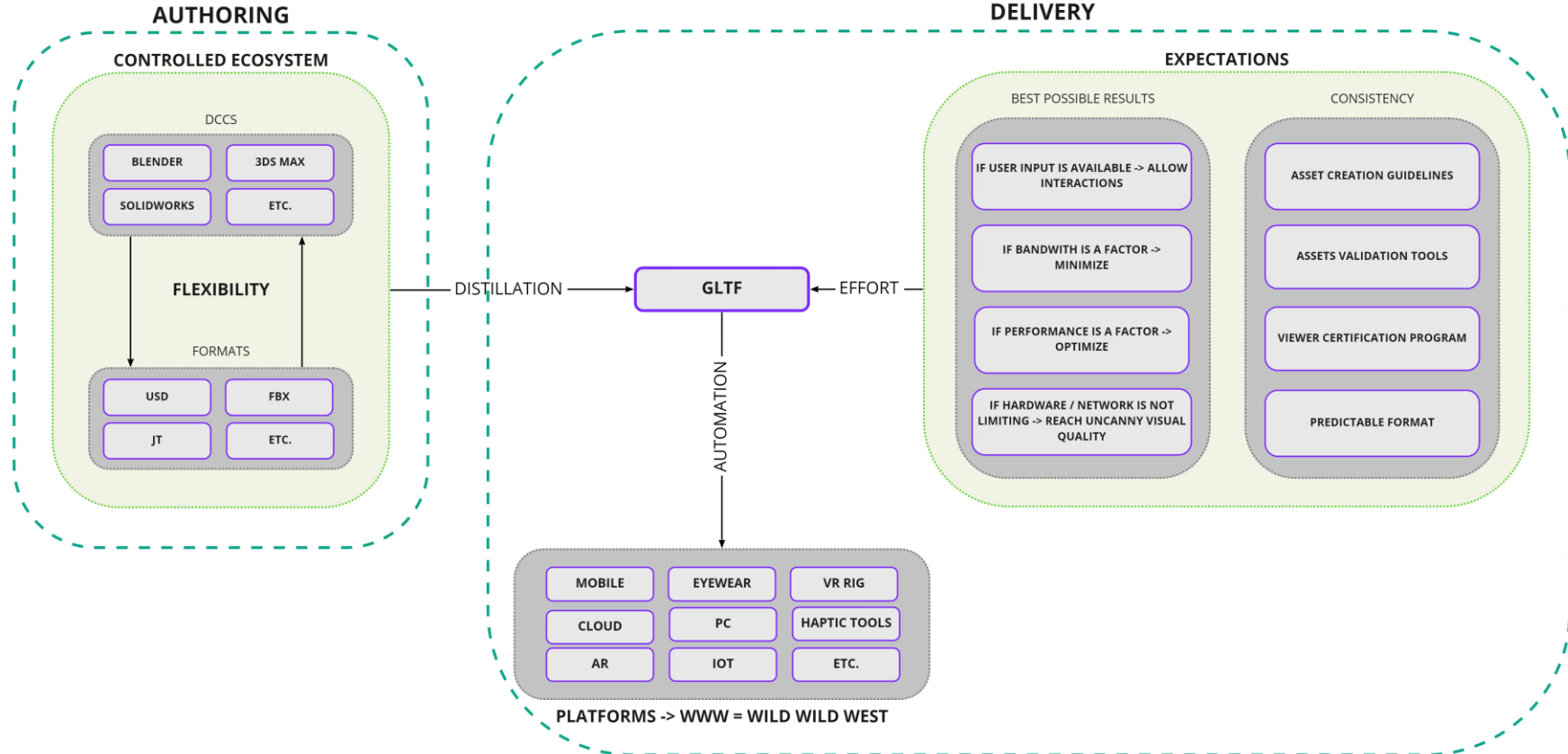
CONTROLLED ECOSYSTEM



EXPECTATIONS



MISSING LINK



GLTF in the Metaverse: Referencing, Interactivity, and Anchoring

Dwight Rodgers (Adobe)

Incorporation by Reference

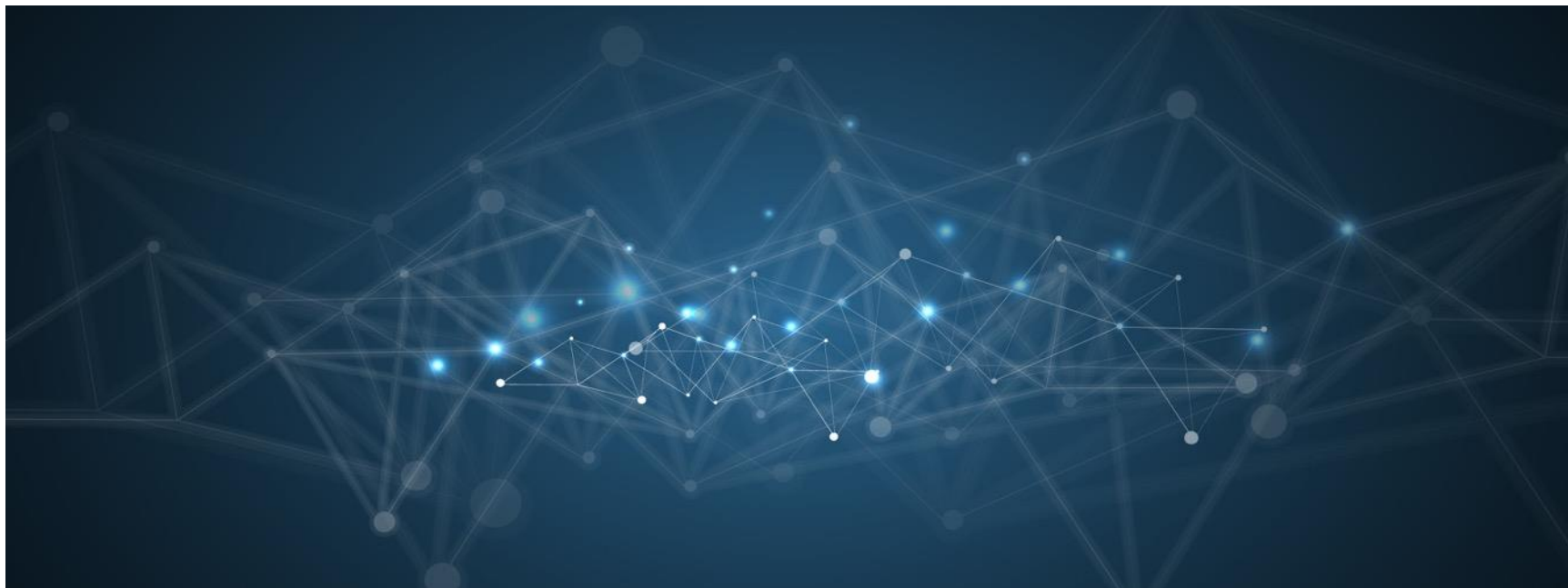


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Why?

Partial loading



Caching parts for reuse



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Personalization & Interactive content



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Structure

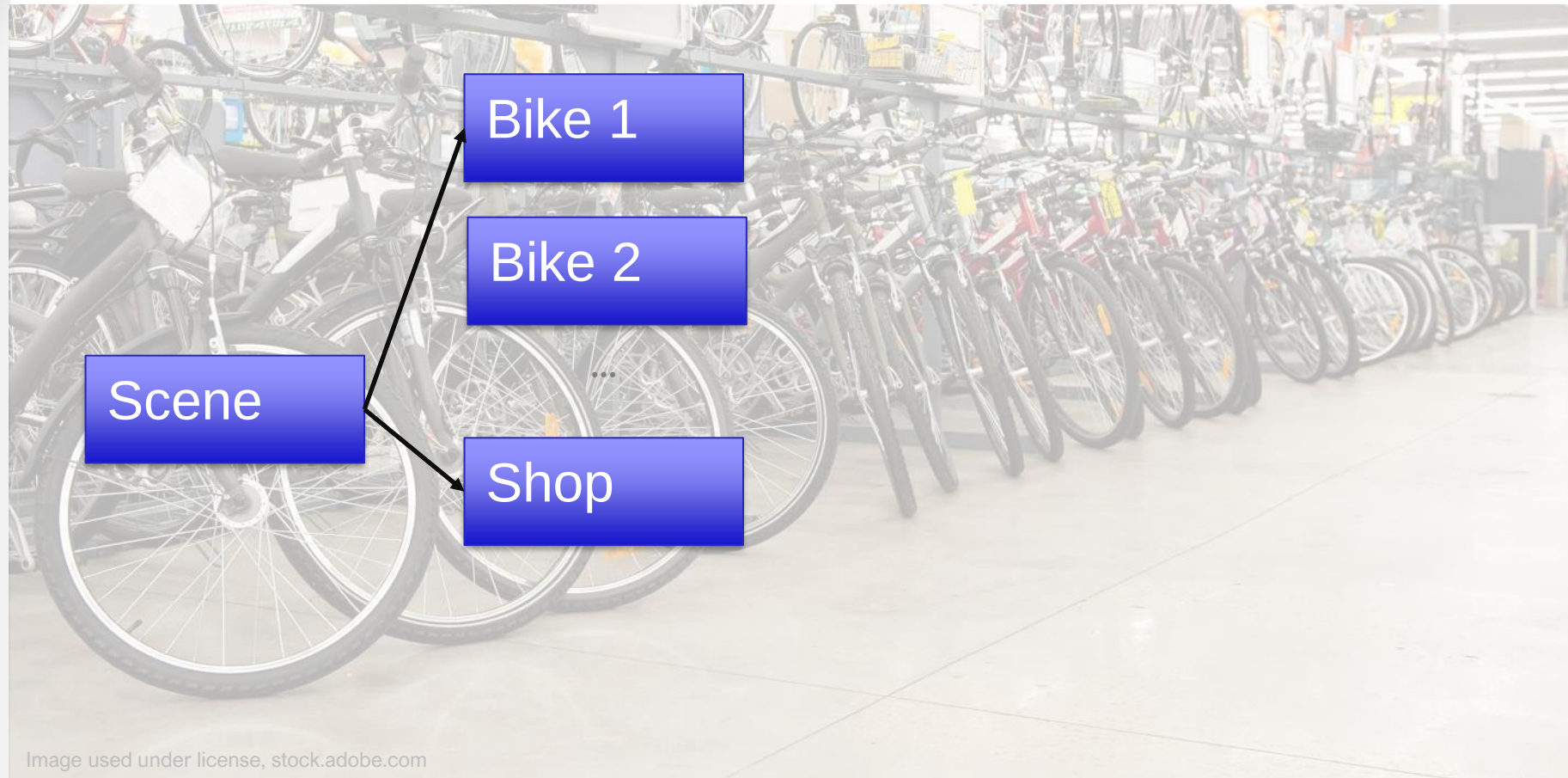


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Structure

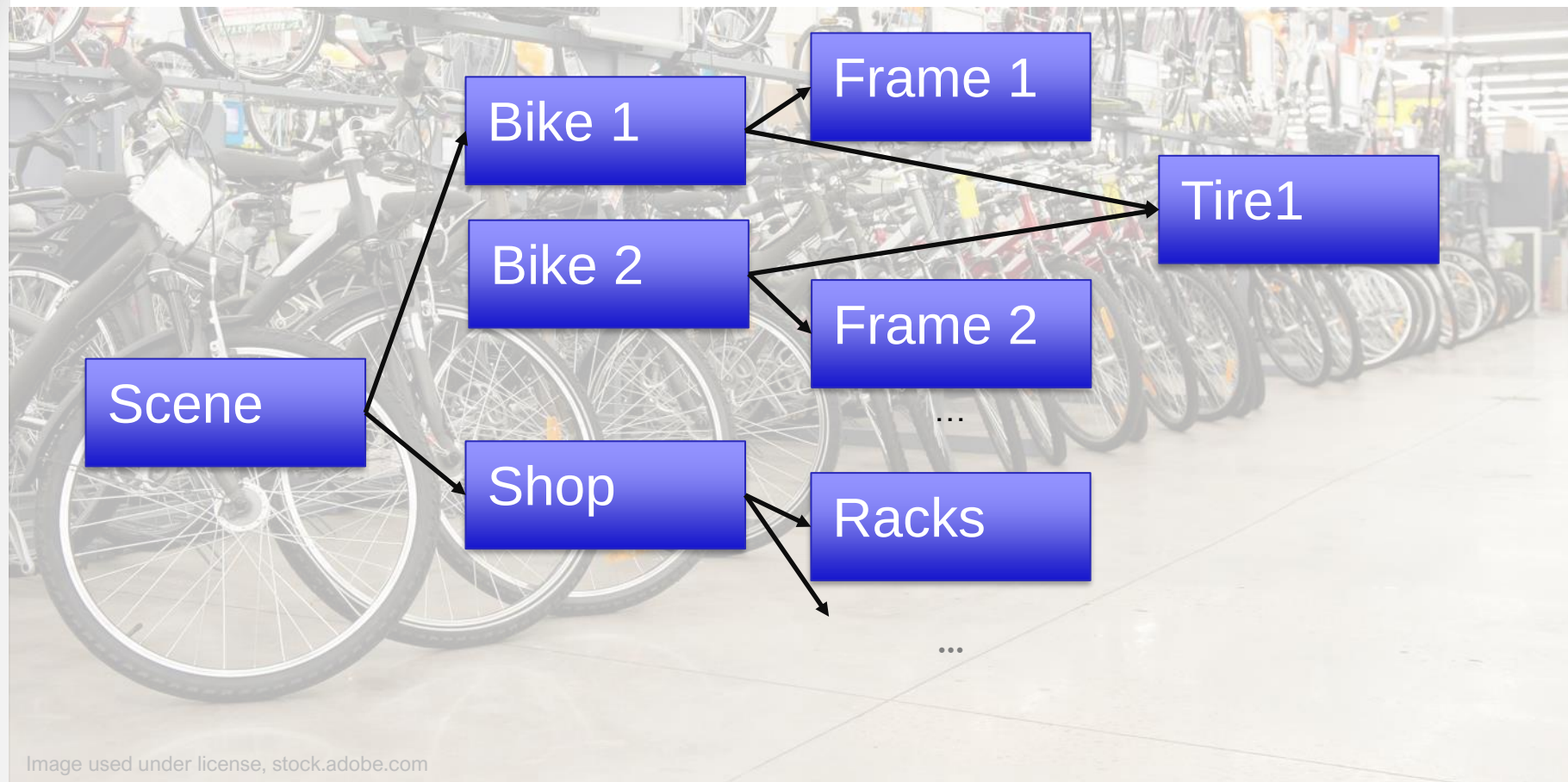
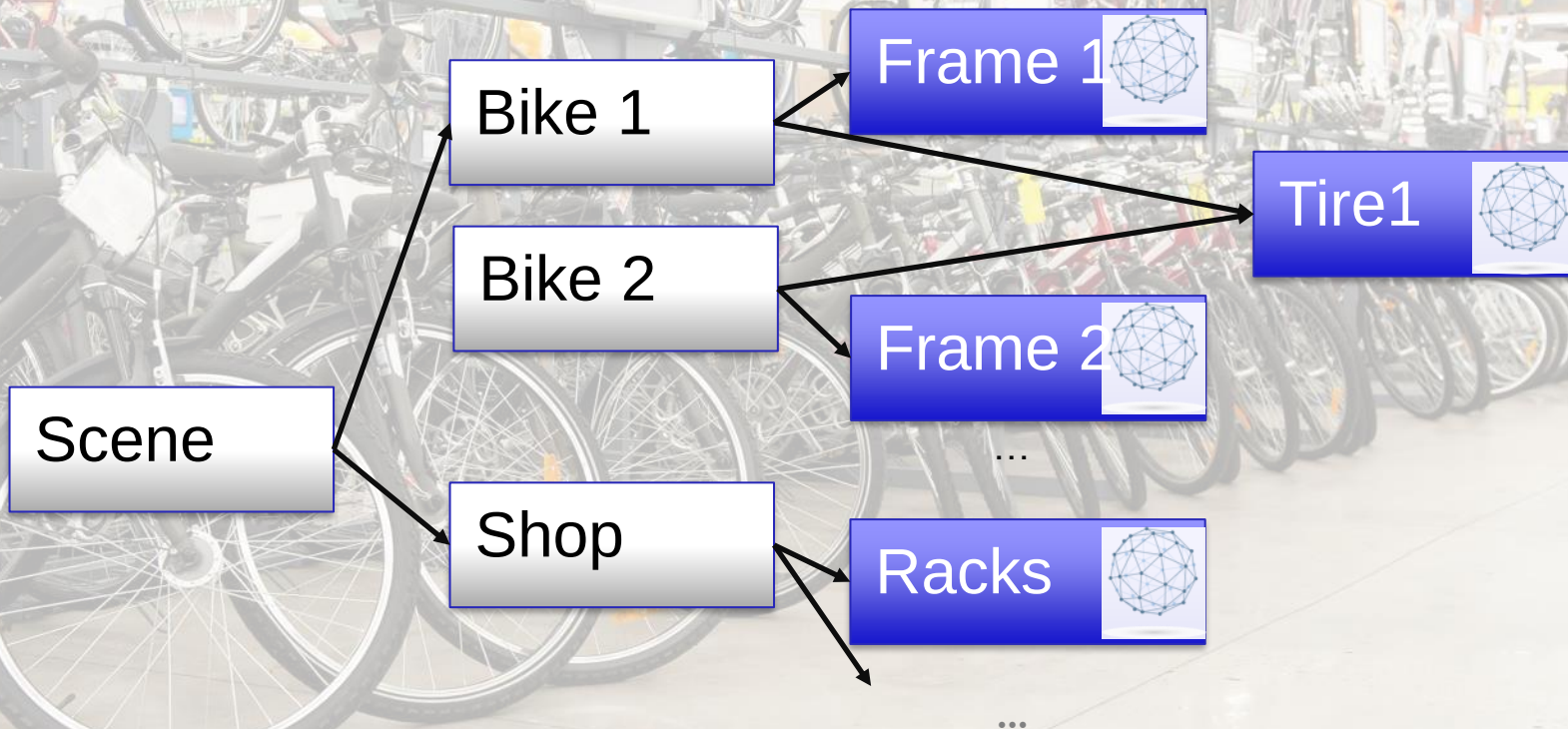
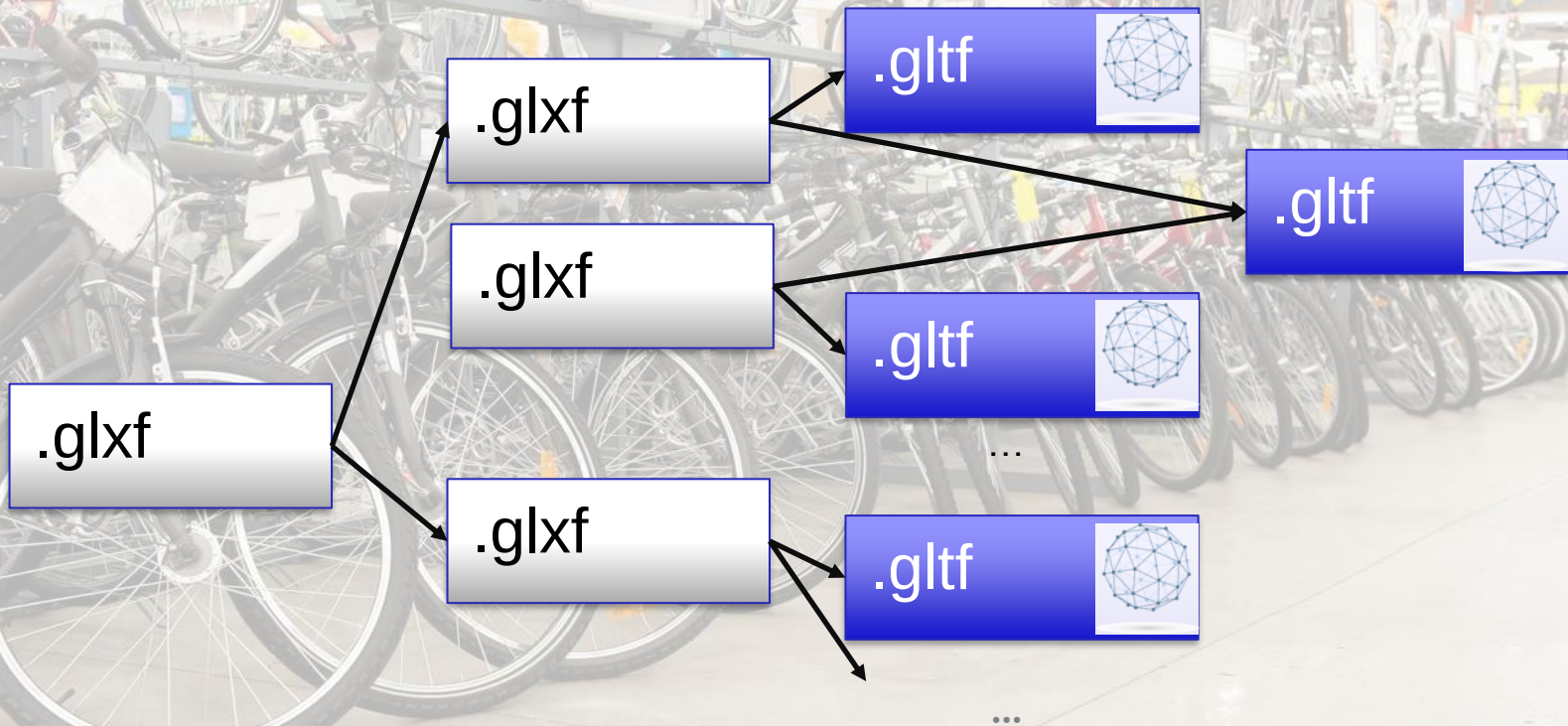


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Structure



Structure



GLXF

.glxf

.gltf

Node graph and transforms

Scenes

Cameras

Extensions

GLXF

- Asset list (URIs)
- Incorporates node-hierarchies or scenes from listed assets

GLTF

- Meshes
- Materials
- Texture Samplers
- Binary data
- Animation data

(note that GLTFs can share texture image references already)

Extensibility on GLXF

.glxf + geospatial extension

.glxf + interactivity extension

.glxf + interactivity extension + geospatial extension

Feedback wanted soon!

Interactivity



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Interactivity

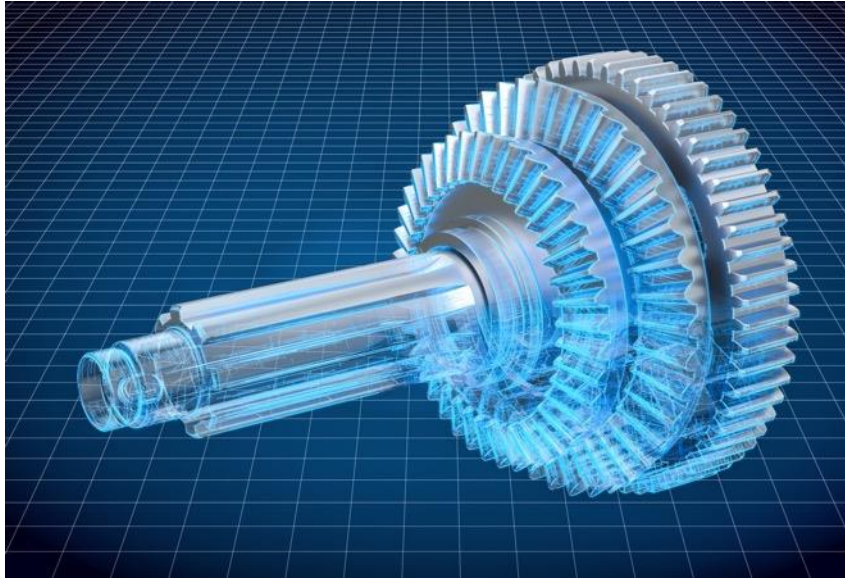


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=
3D Model

Interactivity



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=
3D Model
+
Website

Interactivity

```
5 let introh = intro.innerHeight();
6 let scrollPos = $(window).scrollTop();
7 checkScroll(scrollPos, introh);
8 $(window).on("scroll load resize", function() {
9   introh = intro.innerHeight();
10  scrollPos = $(this).scrollTop();
11  checkScroll(scrollPos, introh);
12  });
13
14
15 function checkScroll(scrollPos, introh) {
16   if(scrollPos > introh ) {
17     header.addClass("fixed");
18   } else {
19     header.removeClass("fixed");
20   }
21 }
```

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=
3D Model
+
Website
+
JavaScript

But this is the Metaverse

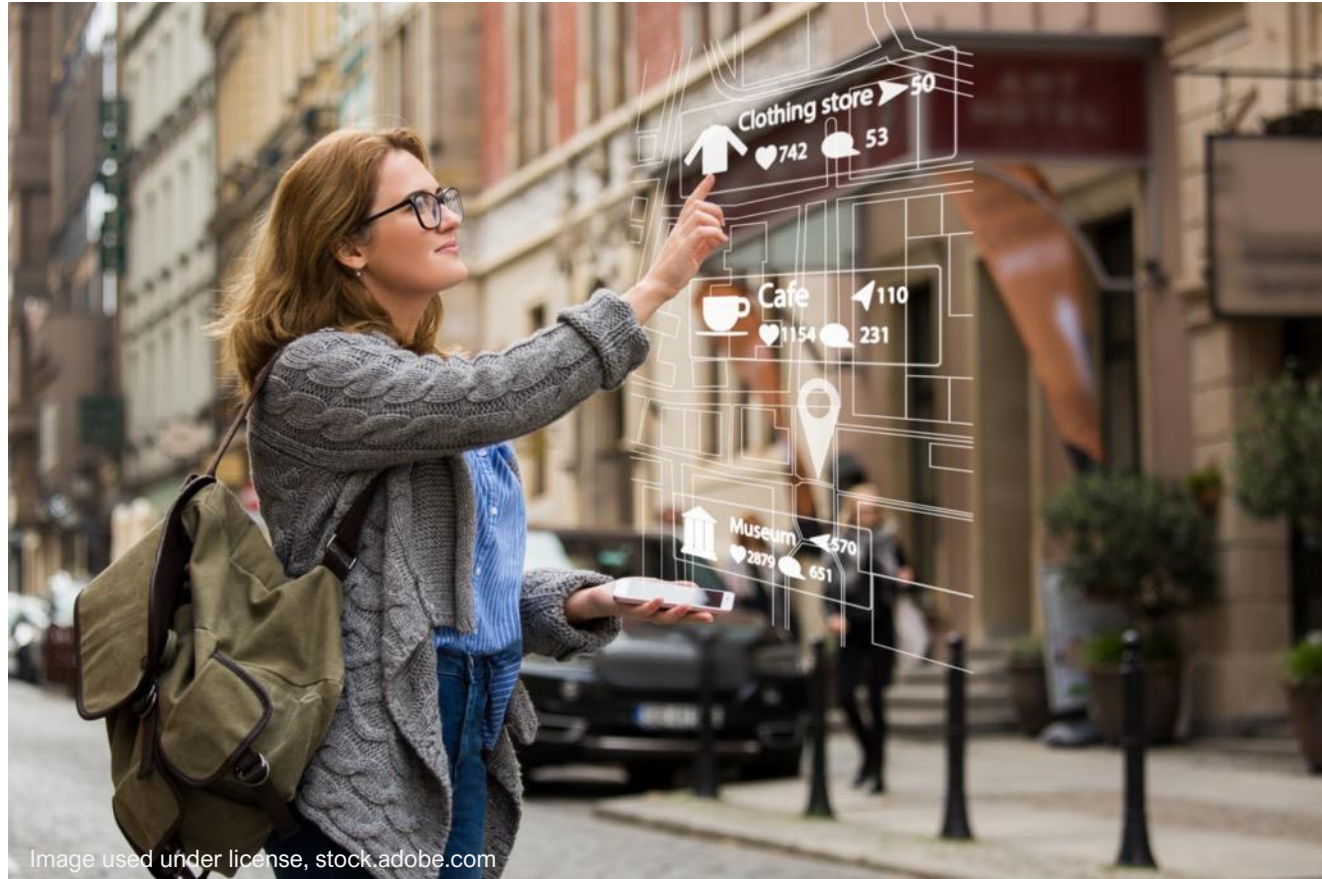


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Interactivity in the GLTF ecosystem

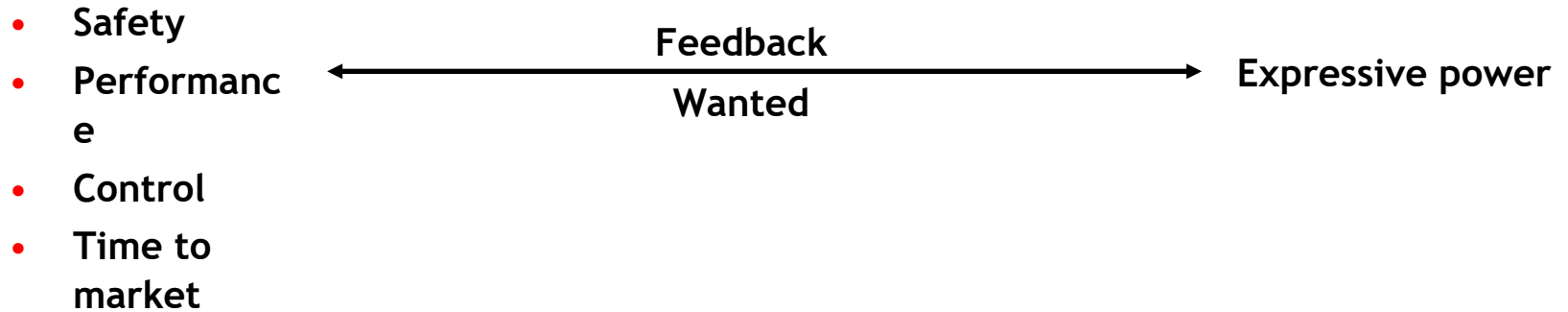
Content + Interactivity

for composing and 3rd party viewers
or other devices

Interactivity in the GLTF ecosystem

Content + Interactivity

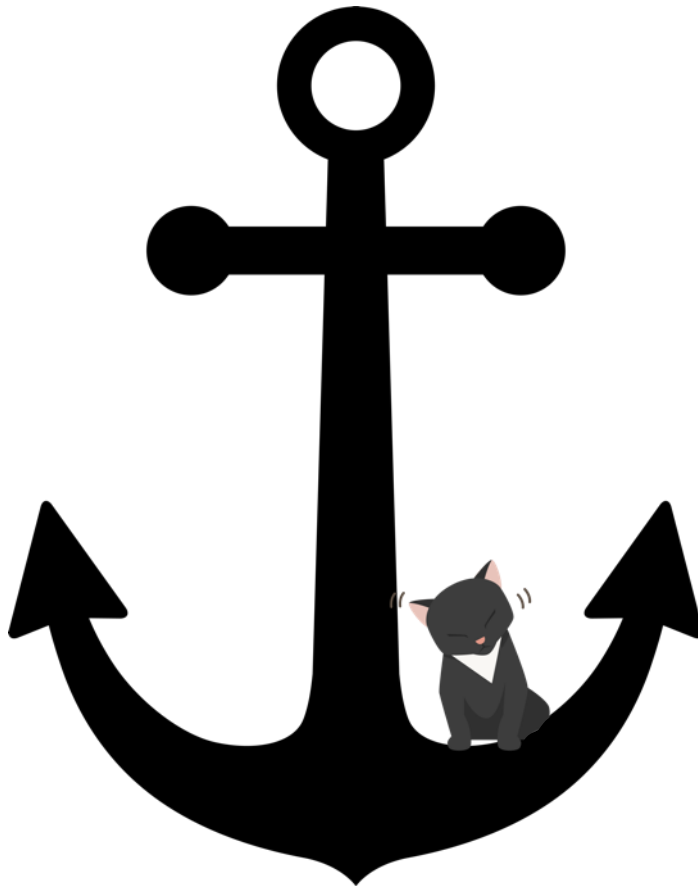
for composing and 3rd party viewers
or other devices



Come see our BoF next Thursday

Again, feedback wanted!

XR Anchors



XR Anchors

**How should a GLTF tell us
where it wants to be?**

Face Anchors



Anchoring a GLTF to a face



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Multiple Anchor Points - one GLTF?



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Multiple Faces?



World Anchors?



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What if I can't see the anchor?

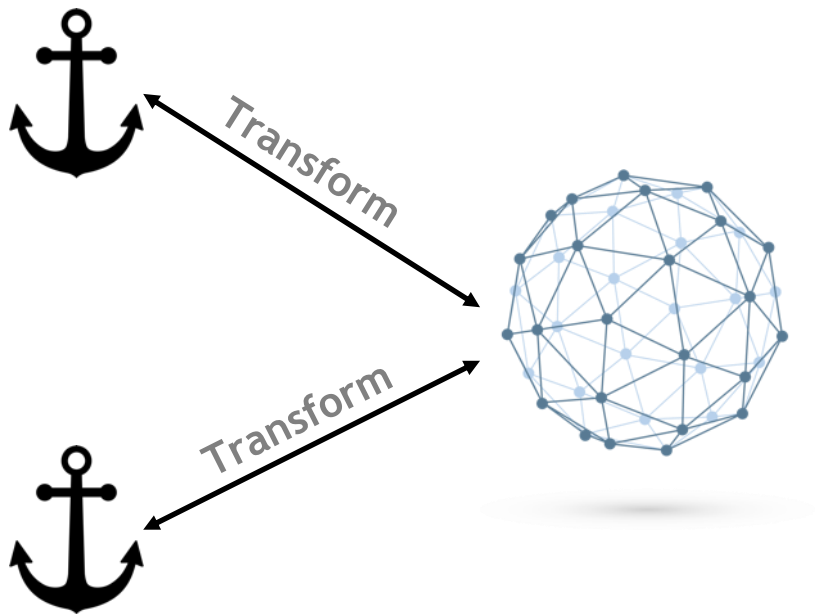


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Because we're looking the other way



Multiple anchorings?

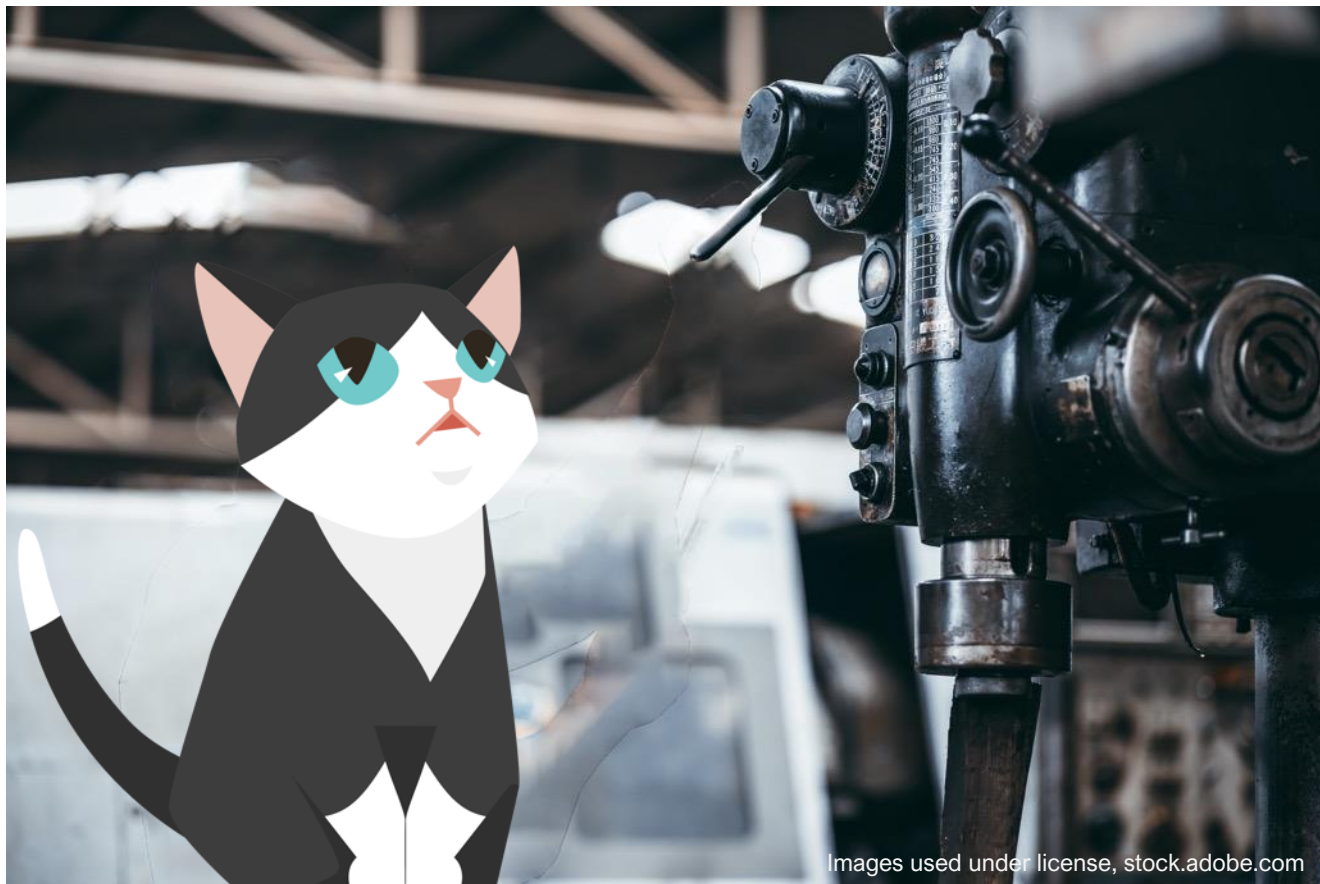


Doors?



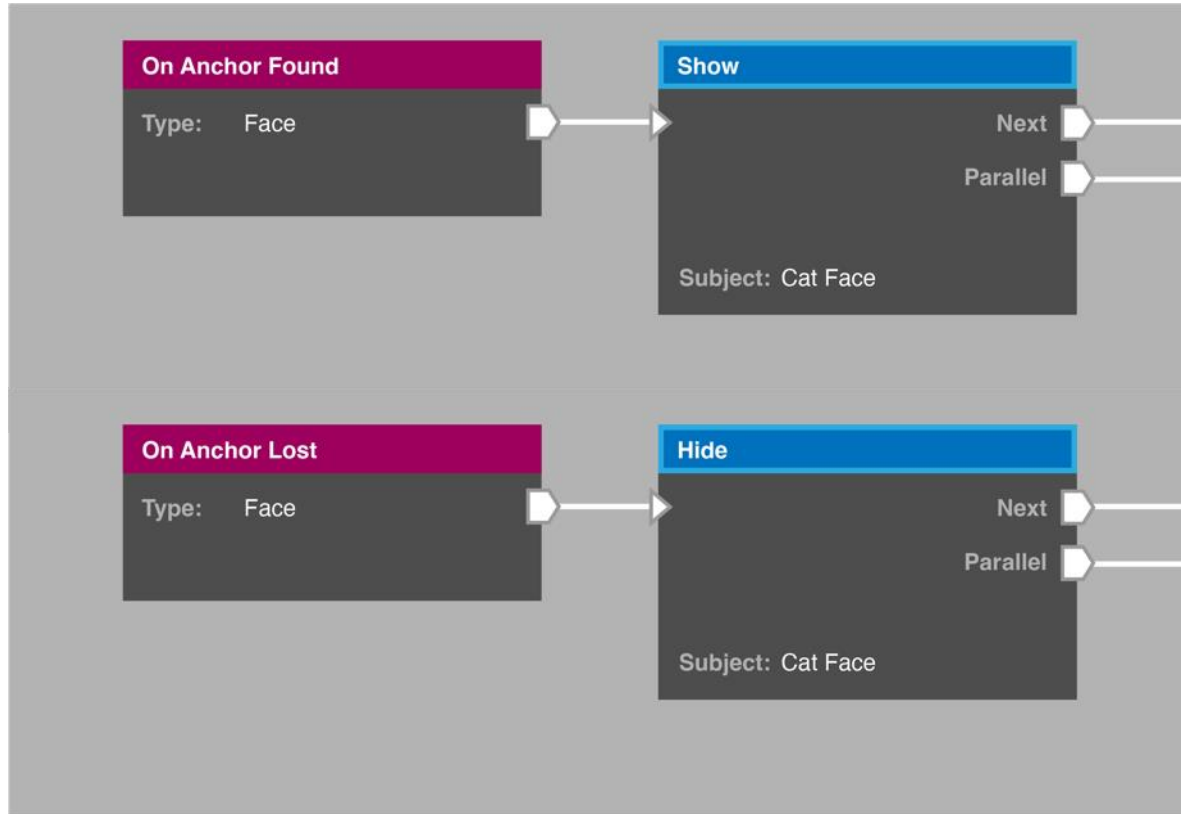
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Equipment?



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Anchoring and Interactivity?



Feedback Wanted



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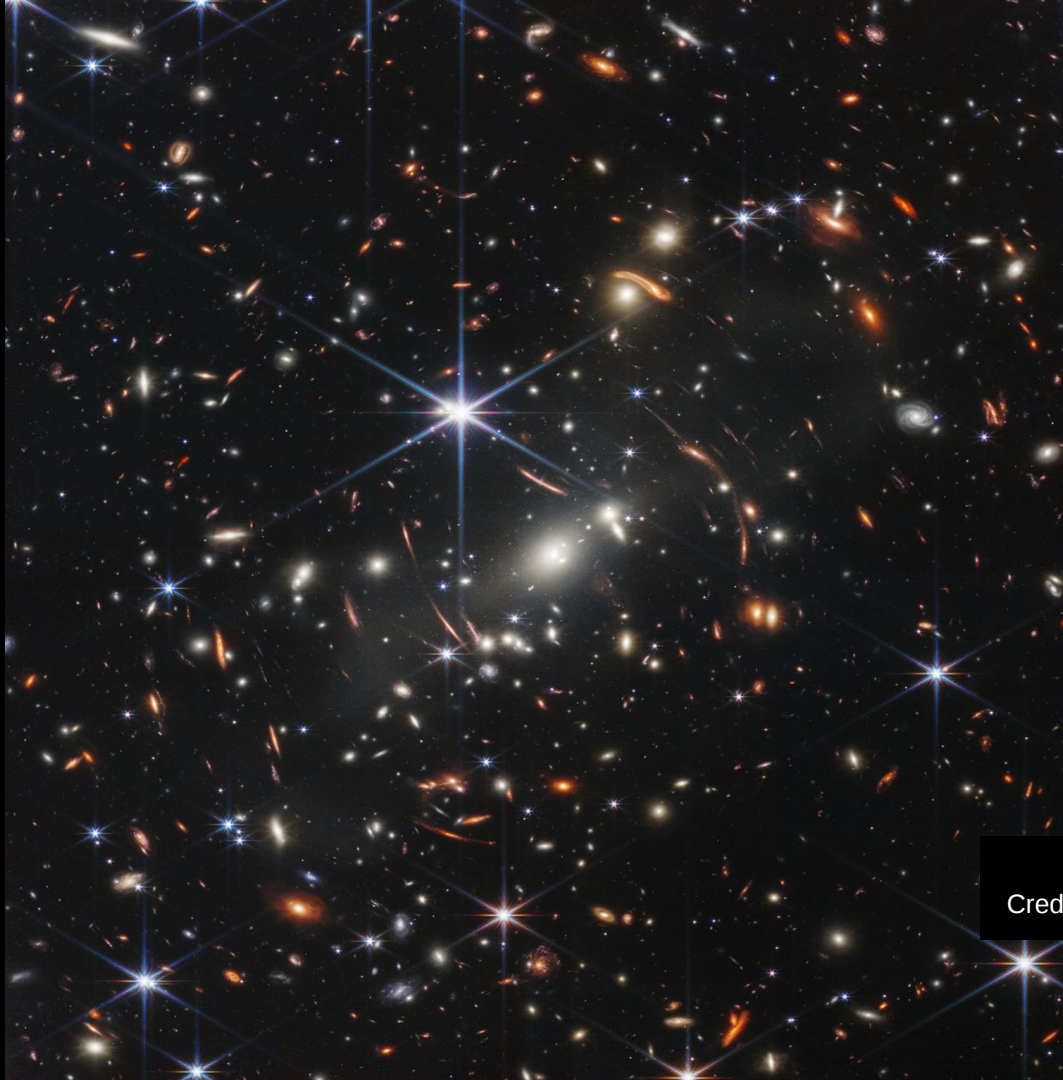
Geospatial in the Metaverse

Leonard Daly
3D Systems Consultant
Daly Realism



Geospatial is Foundational to the Metaverse





[SMACS 0723](#)

Credits: NASA, ESA, CSA, and STScI



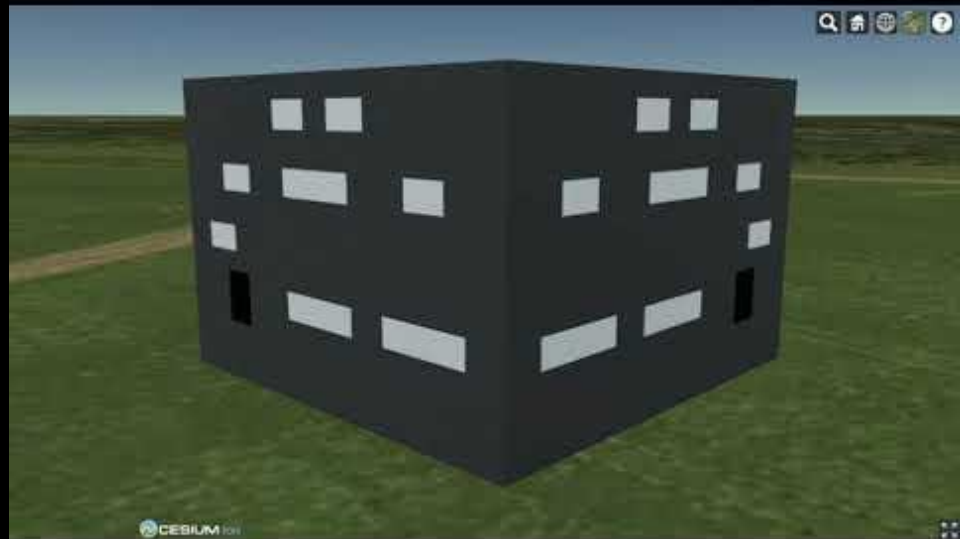
[Carina Nebula](#)

Credits: NASA, ESA, CSA, and STScI

Geospatial Is Foundational



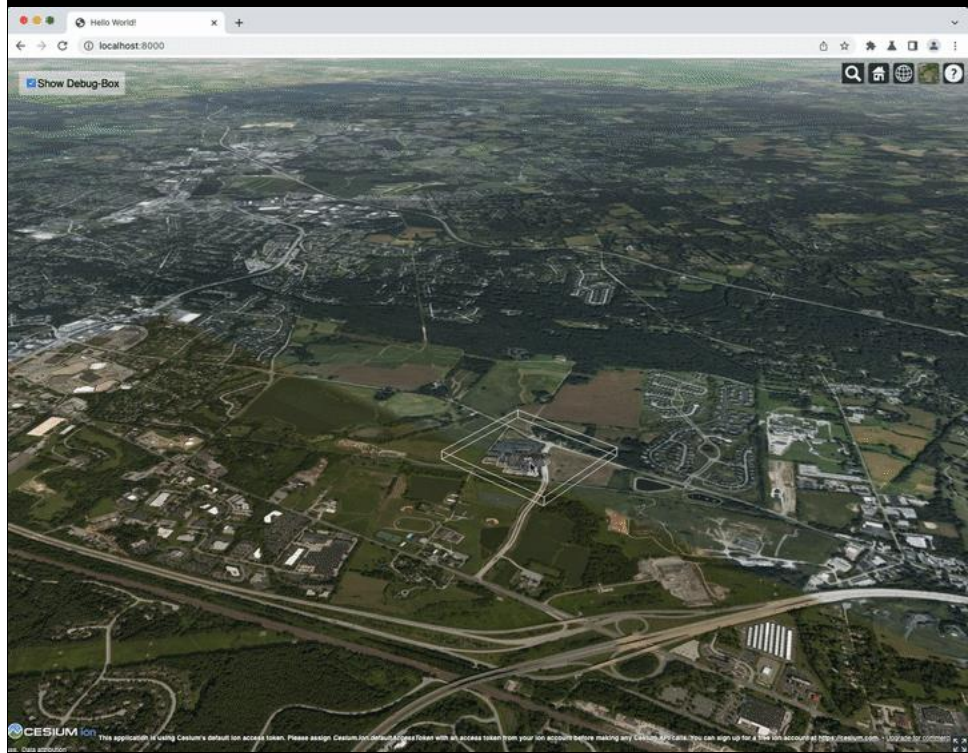
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Video & screen grabs from OGC's YouTube video:
[Gaming and Simulation Compilation](#)

Geospatial Data

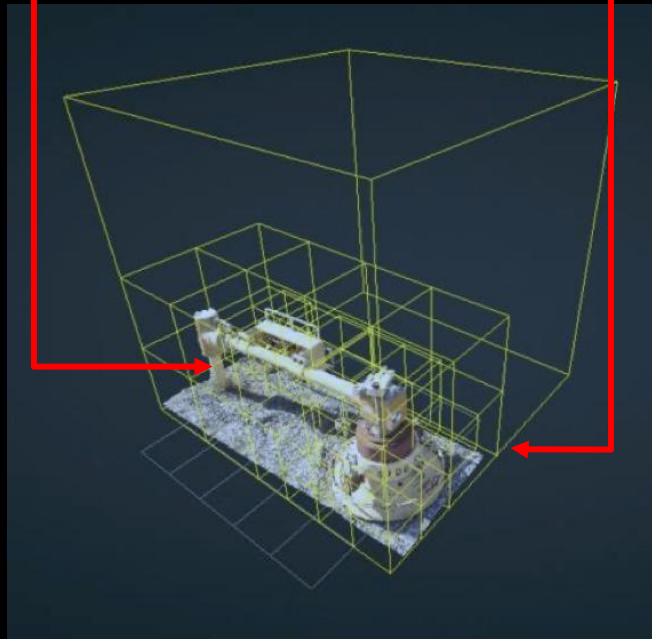
- Data quantity is a major issue
- Even physically small scenes can be > 2GB
- May include mesh models and point cloud data



Managing Data Flow

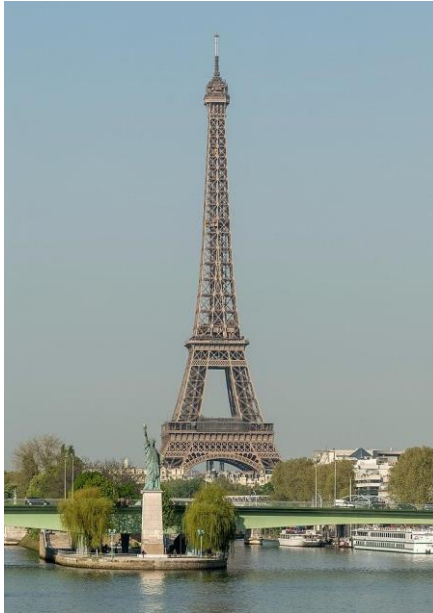
- **glTF Experience Format**
 - “Using glTF for Geospatial, Metaverse, and Beyond” - Wednesday, 1:30pm PDT
 - Conceptually compatible with Esri’s “I3S” and Cesium’s “3D Tiles Next”
- **Use geometry compression**
- **Use compressed image textures (KTX)**

- **Define HLOD**
- **Partition scene**
- **Leaf nodes are glTF files**



Positioning Objects

- Where are objects positioned?



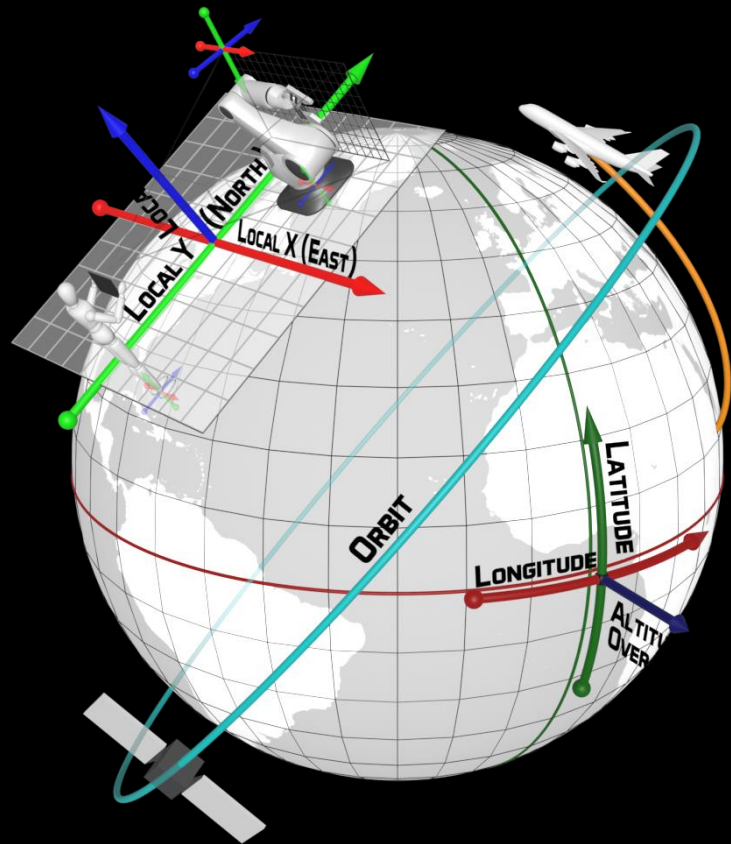
Above: © 2009, [Blaine](#). CC-BY.

Left: © 2009, [Blaine](#). CC-BY.

Right: © 2014, [Paris 16](#). CC-BY.

GeoPose

- Open Geospatial Consortium's (draft) specification for location and orientation



Anchors

- W3C IW
- OpenXR
- glTF

Use logos for
above

W3C, IW

OpenXR

glTF

OGC



[Streets of Shanghai at night](#)
(c) 2013, [Mstyslav Chernov](#). CC-BY-SA

Geospatial Solutions Directly Solve Metaverse Problems

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Logos are property of their respective owners

Contacts

- “Using glTF for Geospatial, Metaverse, and Beyond” BOF (Wednesday, 1:30pm PDT)
- Khronos Group - <https://khronos.org>
- Leonard Daly - <https://www.linkedin.com/in/leonarddaly/>

The Metaverse Standards Forum and glTF

Neil Trevett, NVIDIA

Fostering Metaverse Interoperability

What will the metaverse be?

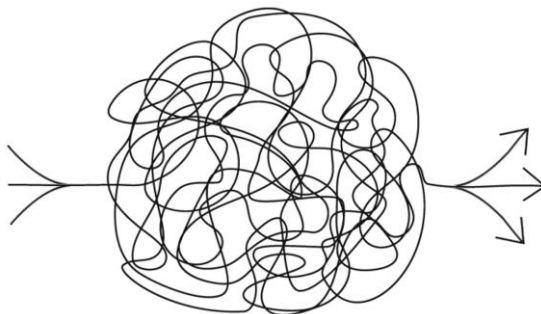
Some mix of the connectivity of the web with the immersiveness of spatial computing

Diverse technologies will need to work together in novel ways – driving the need for a constellation of interoperability standards

Synthetic visual reality, practical XR optics, real-time environment scanning and semantic understanding, end-user 3D content creation tooling, accurate physical simulations, effective remote social interactions, servers scaling to millions of simultaneous users, streaming of vast geospatial data sets, real-world geo-anchoring with persistence, universal digital twins, online personas and social connections, realistic avatars, universally sharable consumer assets, security, privacy, interoperable run-times, online economies and currencies, IOT sensor networks, pervasive low-latency wireless connectivity ... and many more

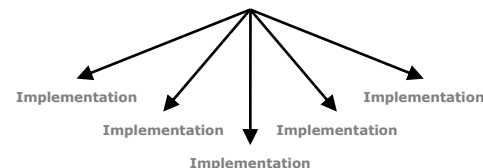
...

Darwinian Evolution



Standards enable pervasive deployment of proven technologies to build market opportunities for all

Open interoperability standard specifications and conformance tests



Metaverse Standards Forum Mission

Identify TODAY'S interoperability pain points and coordinate pragmatic action to help solve them through standardization



**Metaverse
STANDARDS FORUM™**

The Vision

**A Venue for
Cooperation between
Standards Organizations and Companies to
Foster the Development of
Interoperability Standards for an
Open and Inclusive Metaverse**



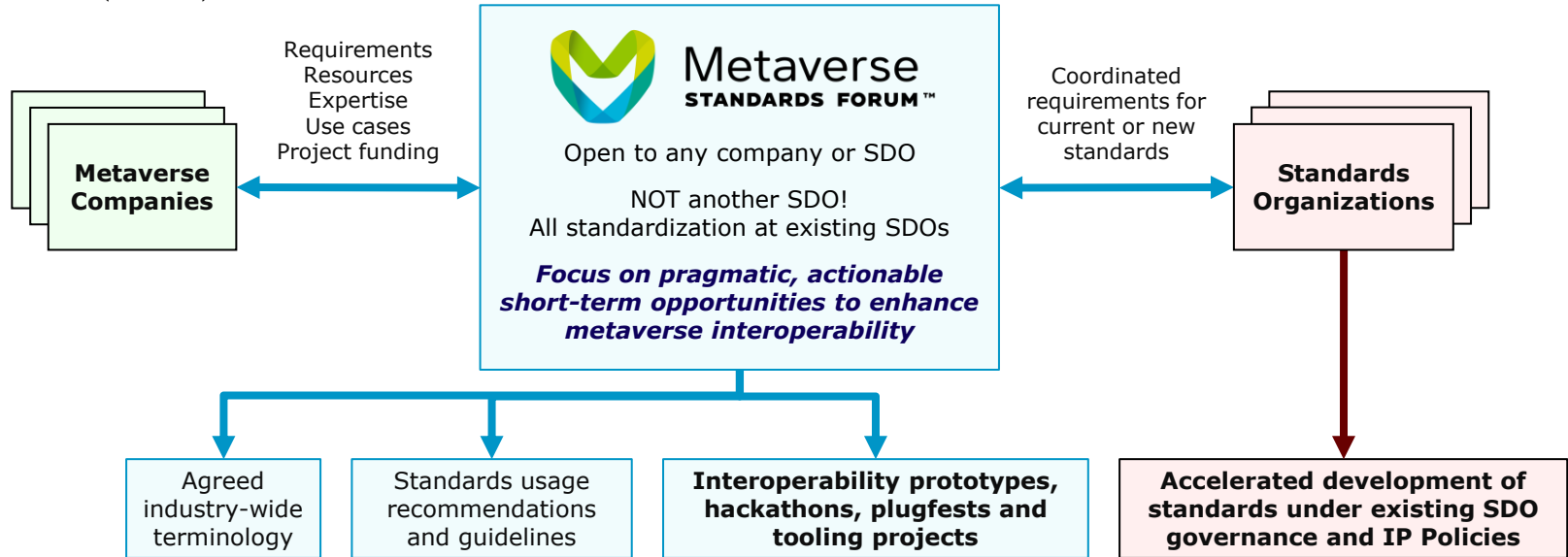
Forum was initiated by Khronos,
and is being hosted by Khronos
for fast organizational bootstrap



Metaverse
STANDARDS FORUM™

Metaverse Standards Forum

- Launched on June 21st 2022
- Open to all, no participation fee, no NDA, no IP framework
- Coordinated cooperation between industry and Standards Developing Organizations (SDOs)



Over 1200 Members and Counting

Wide diversity of organizations, including...

Platforms

Meta, Microsoft, Sony, Google, Baidu, Huawei, General Motors, RedHat

Tools and Engines

Epic, Unity, Adobe, Autodesk, Otoy, Maxon, Cesium, Blackshark.ai, Croquet, Lamina1, Ready Player Me, Manticore, Avataar

XR

HTC, Magic Leap, Nreal, Panasonic, Tobii

Hardware

NVIDIA, Intel, AMD, Qualcomm, Samsung, MediaTek, Oppo, Lenovo, ZTE, LG

Wireless Carriers

China Telecom, T-Mobile, Verizon

3D Commerce

Alibaba, Wayfair, IKEA, Avataar, VNTANA

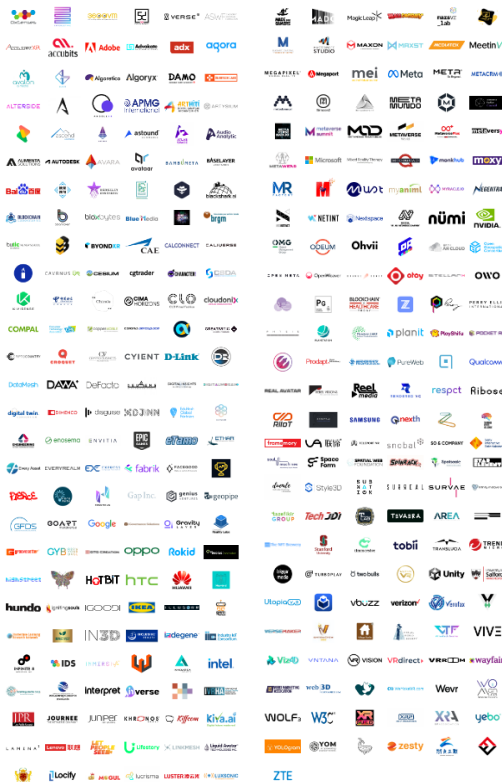
Universities and Institutes

Stanford, John Hopkins, Yale (XRP), Queens University Belfast, University Salford, New York Institute Technology, APMG

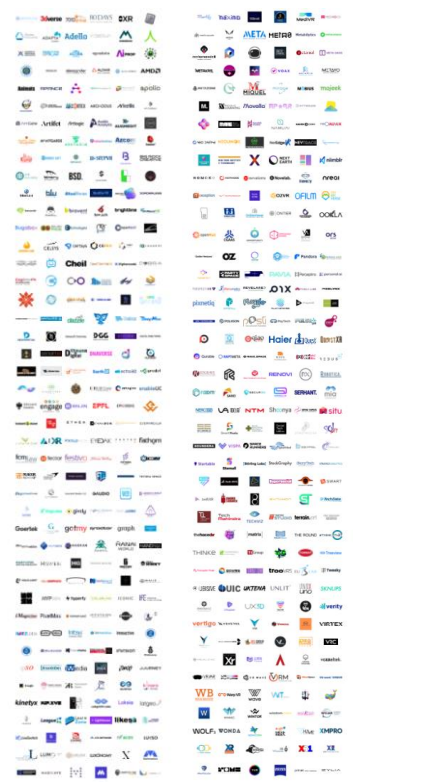
Advocacy

XRSI, XR Association, VRAR Association, XR Guild, Web3 Marketing Association, Metaverse Fashion Council, International Virtual Reality Healthcare, Swiss Institute for Disruptive Innovation, IOT Consortium, RIAA

Principals



Participants



Standards Developing Organizations in the Forum so far



Organizing for Effective Forum Action

Gather wide member input online
Establish focused groups ASAP

1. Gather interoperability Topics from all members

Online input from all members on actionable topics that need improvement today!

**Close to 200 topics suggested and counting..
... some examples so far**

Database of metaverse standards
Taking 3D assets between worlds
Asset LODs
gITF / USD interoperability
Avatar customization / animation
3D Apparel and Fashion
Cloth Simulation
Metaverse traversal
Geospatial ontologies
Geospatial streaming
Decentralized User ID
Ethical framework
User privacy
Child safety
Payment frameworks
Metaverse Pharmacy
Etc. etc..

2. Organize Topics into Domains

Consensus on where is member interest AND the Forum has quorum to add industry value

Topics naturally falling into Domains

	Upvotes
Metaverse Standards Registry	47
Interoperable 3D Assets	103
Avatars and Apparel	44
Real/Virtual World Integration	51
Geospatial	21
User Identity and Login	47
Ethics, Privacy, Accessibility, Safety	70
Payments and Economy	31
Governance and Advocacy	36
Teaching, Education, Exams, Certification	27
XR and UI	29
Metaverse Definition	21
Runtimes and Object Model	17
Networking	8
Tooling and Creators	8
Health and Medical	5
Business Analytics	4
Performance and Scalability	5
Gaming	4
Miscellaneous	3



Domain Working Groups and Projects will be formed and start work in 3Q22

4. Working Group Projects

Self organizing focus on specific project execution

5. Publish Project Work Products

Examples

Standards Registry

Guidelines and recommendations

Open-source tooling

Plugfest resources and reports

Requirements to pass to Standards Developing Organizations

...

Example Asset Interoperability Testbed Project

- Goals
 - Confirm asset behaviours and attributes satisfaction
 - Test publishing and transmission pipeline
 - Exercise interoperable behaviours in multiple engines
- All engine and platform vendors invited to participate
- Cooperative shared open-source and assets



USD-based tools
Author assets and publish into glTF



DISTILL



Web-based Configurator
Material variants



TRANSMIT



Runtime Demos
Open door, start engine
Drive course with physics simulation

AUTODESK

FORTNITE

ROBLOX



three.js



Tools create assets
using open standards

Run time engines ingest and
process assets

Broadening glTF Industry Engagement

The Metaverse Standards Forum significantly broadens industry input and engagement in glTF for the Metaverse

glTF Advisory Panel for contributions and feedback under the Khronos IP Framework



**Metaverse
STANDARDS FORUM™**

Any company welcome to join!
<https://metaverse-standards.org/>



**KHRONOS®
GROUP**
3D Formats Working
Group Members



glTF Public GitHub for extension proposals and discussions

Question and Answer



Neil Trevett
(NVIDIA)



Nathaniel Hunter
(Infinite World)



Brent Scannell
(Autodesk)



Leonard Daly
(Daly Realism)



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(Adobe)



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